DeviceNet Adapter User Manual

FnIO S-Series

NA-9111 / NA-9112

List of revisions

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1. Product Specifications

1) General Specifications

Item		Specifications	Remarks
Temperature	Operating	-0℃ to +60℃ (32℉ to 140℉)	
	Storage	-40℃ to +85℃ (-40℉ to 185℉)	
Humidity	Operating	5 to 95% RH (Non-condensing)	
	Storage	5 to 95% RH (Non-condensing)	
Vibration immunity		10 TO 55Hz,double amplitude of 0.75mm, 10minutes on each of 3 axes (X,Y,Z)	
Shock Immunity		Peak acceleration and duration 15g/11ms, 3 times on each of 3 axes (X,Y,Z)	
Capsuling		Din rail or screw tightening	

2) DeviceNet Communication Specification

Item	Specification	Remarks
Network Protocol	I/O Slave Messaging (Group 2 Only slave) - Poll command : yes - Bit_STROBE command : yes - Cyclic command : yes - COS command : yse	
Network length	Max.500Meter (125Kbps) Max.250Meter (250Kbps) Max.100Meter (500Kbps)	
Number of Nodes	64 Node/Max	Rotary switch
Communication speed	125Kbps, 250Kbps, 500Kbps	Auto Baudrate selection
Number of Expansion I/O	Max. 32 Slots	
Isolation	Non-Isolation (DeviceNet to Logic)	
DeviceNet Power	Rate voltage: 24V DC nominal Voltage range: 11 to 28.8 V DC Current consumption: Max 1.5w	

2. DeviceNet Setting

DeviceNet setting include the following configurations:

- Communication parameter setting
- I/O allocation
- DeviceNet I/O Data Format Setting
- EDS & I/O Module setting

1) Communication Parameter Setting

◆ Node Address Setting

- NA-9111/9112 Node address is determined by the node address rotary switch on the front panel of adapter module.
- Set node address is recognized on the power-on of adapter module.

Ex) When node address is set as 27:
Device MAC ID Setting :(2*10 + 1*7)= 27

X 10 (MSD)

X 1 (LSD)

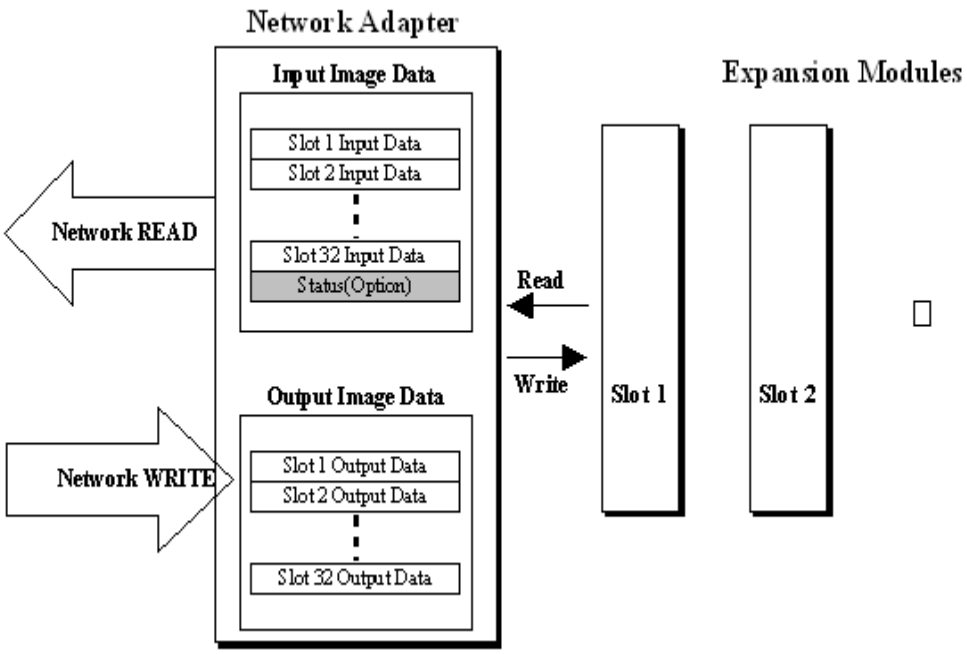
* Each DeviceNet Adaptor has MAC ID from no.0 to 63

◆ Communication Speed Setting

- See Master Setting about communication speed setting.

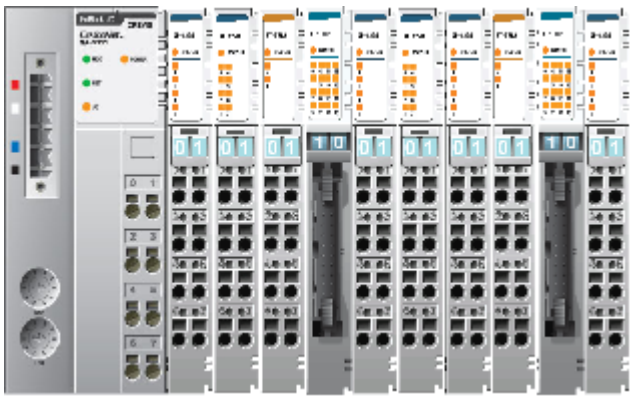
2) I/O Allocation

The expansion Module connecting to Adaptor has 3 types of Data types (I/O Data, Configuration Parameters, Memory Resister) These data are exchanging I/O Process image Data via FnBus Protocol between Adaptor and Expansion Module as below ;



◆ Input Image Data is determined by the position of Slot and Expansion Module.

= For Example



Slot Address	Module Description

0	DeviceNet Adaptor
1	4-Discrete input
2	8-Discrete input
3	2-Analog input
4	16-Discrete input
5	4-Discrete input
6	8-Discrete input
7	4-Discrete input
8	2-Analog input
9	16-Discrete input
10	4-Discrete input

◆ Input Instance Attributes

Instance ID	Attribute ID	Access Rule	Description
100	3	Get	Status+Uncompressed Input Data
101	3		Status+compressed Input Data
102	3		Uncompressed Input Data
103	3		Compressed Input Data

● Assembly Priority of Compressed Mode :

1) Analog IO Data
2) 8 or 16 points Discrete IO Data
3) 4 points IO Data
4) 2 Points IO Data

◆ Instance type 100(Status + Uncompressed Input Processing Data)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Field Power	FnBus Status						
1	Reserved				Discrete Input 4 pts (Slot#1)			
2	Discrete Input 8 pts (Slot#2)							
3	Analog Input CH0 low byte (Slot#3)							
4	Analog Input CH0 high byte (Slot#3)							
5	Analog Input CH1 low byte (Slot#3)							
6	Analog Input CH1 high byte (Slot#3)							
7	Discrete Input low 8 pts (Slot#4)							
8	Discrete Input high 8 pts (Slot#4)							
9	Reserved				Discrete Input 4 pts (Slot#5)			
10	Discrete Input 8 pts (Slot#6)							
11	Reserved				Discrete Input 4 pts (Slot#7)			
12	Analog Input CH0 low byte (Slot#8)							

13	Analog Input CH0 high byte (Slot#8)	
14	Analog Input CH1 low byte (Slot#8)	
15	Analog Input CH1 high byte (Slot#8)	
16	Discrete Input low 8 pts (Slot#9)	
17	Discrete Input high 8 pts (Slot#9)	
18	Reserved	Discrete Input 4 pts (Slot#10)

● Field Power :

0 : 24Vdc Field Power On, 1 : 24Vdc Field Power Off

● FnBus Status :

0 : Normal Operation, 1 : FnBus Standby

2 : FnBus Communication Fault, 3 : Slot Configuration Failed

4 : No Expansion Slot

◆ Instance type 101(Status + compressed Input Processing Data)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Field Power	FnBus Status						
1	Analog Input CH0 low byte (Slot#3)							
2	Analog Input CH0 high byte (Slot#3)							
3	Analog Input CH1 low byte (Slot#3)							
4	Analog Input CH1 high byte (Slot#3)							
5	Analog Input CH0 low byte (Slot#8)							
6	Analog Input CH0 high byte (Slot#8)							
7	Analog Input CH1 low byte (Slot#8)							
8	Analog Input CH1 high byte (Slot#8)							
9	Discrete Input 8 pts (Slot#2)							
10	Discrete Input low 8 pts (Slot#4)							
11	Discrete Input high 8 pts (Slot#4)							
12	Discrete Input 8 pts (Slot#6)							
13	Discrete Input low 8 pts (Slot#9)							
14	Discrete Input high 8 pts (Slot#9)							
15	Discrete Input 4 pts (Slot#5)				Discrete Input 4 pts (Slot#1)			
16	Discrete Input 8 pts (Slot#10)				Discrete Input 8 pts (Slot#7)			

● Input Assembly Priority

5) Analog IO Data

6) 8 or 16 points Discrete IO Data

7) 4 points IO Data

8) 2 point IO Data

◆ Instance type 102(Uncompressed Input Processing Data)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Reserved				Discrete Input 4 pts (Slot#1)			
1	Discrete Input 8 pts (Slot#2)							
2	Analog Input CH0 low byte (Slot#3)							
3	Analog Input CH0 high byte (Slot#3)							
4	Analog Input CH1 low byte (Slot#3)							
5	Analog Input CH1 high byte (Slot#3)							
6	Discrete Input low 8 pts (Slot#4)							
7	Discrete Input high 8 pts (Slot#4)							
8	Reserved				Discrete Input 4 pts (Slot#5)			
9	Discrete Input 8 pts (Slot#6)							
10	Reserved				Discrete Input 4 pts (Slot#7)			
11	Analog Input CH0 low byte (Slot#8)							
12	Analog Input CH0 high byte (Slot#8)							
13	Analog Input CH1 low byte (Slot#8)							
14	Analog Input CH1 high byte (Slot#8)							
15	Discrete Input low 8 pts (Slot#9)							
16	Discrete Input high 8 pts (Slot#9)							
17	Reserved				Discrete Input 4 pts (Slot#10)			

◆ Instance type 103(Compressed Input Processing Data)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Analog Input CH0 low byte (Slot#3)							
1	Analog Input CH0 high byte (Slot#3)							
2	Analog Input CH1 low byte (Slot#3)							
3	Analog Input CH1 high byte (Slot#3)							
4	Analog Input CH0 low byte (Slot#8)							
5	Analog Input CH0 high byte (Slot#8)							
6	Analog Input CH1 low byte (Slot#8)							
7	Analog Input CH1 high byte (Slot#8)							
8	Discrete Input 8 pts (Slot#2)							
9	Discrete Input low 8 pts (Slot#4)							
10	Discrete Input high 8 pts (Slot#4)							
11	Discrete Input 8 pts (Slot#6)							
12	Discrete Input low 8 pts (Slot#9)							
13	Discrete Input high 8 pts (Slot#9)							
14	Discrete Input 4 pts (Slot#5)				Discrete Input 4 pts (Slot#1)			
15	Discrete Input 8 pts (Slot#10)				Discrete Input 8 pts (Slot#7)			

◆ Output Image Data is determined by the position of Slot and Expansion Module.

= For Example

Slot Address	Module Description
0	DeviceNet Adaptor
1	4-Discrete Output
2	8-Discrete Output
3	2-Analog Output
4	16-Discrete Output
5	4-Discrete Output
6	8-Discrete Output
7	2-Relay Output
8	2-Relay Output
9	2-Analog Output
10	16-Discrete Output
11	4-Discrete Output

◆ Output Instance Attributes

Instance ID	Attribute ID	Access Rule	Description
150	3	Get	Uncompressed Output Data
151	3		Compressed Out Data

◆ Instance type 150(Uncompressed Output Processing Data)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Reserved				Discrete Output 4 pts (Slot#1)			
1	Discrete Output 8 pts (Slot#2)							
2	Analog Output CH0 low byte (Slot#3)							
3	Analog Output CH0 high byte (Slot#3)							
4	Analog Output CH1 low byte (Slot#3)							
5	Analog Output CH1 high byte (Slot#3)							
6	Discrete Output low 8 pts (Slot#4)							

7	Discrete Output high 8 pts (Slot#4)	
8	Reserved	Discrete Output 4 pts (Slot#5)
9	Discrete Input 8 pts (Slot#6)	
10	Reserved	Output 2 pts(Slot#7)
11	Reserved	Output 2 pts(Slot#8)
12	Analog Output CH0 low byte (Slot#9)	
13	Analog Output CH0 high byte (Slot#9)	
14	Analog Output CH1 low byte (Slot#9)	
15	Analog Output CH1 high byte (Slot#9)	
16	Discrete Output low 8 pts (Slot#10)	
17	Discrete Output high 8 pts (Slot#10)	
18	Reserved	Discrete Output 4 pts (Slot#11)

◆ Instance type 151(Compressed Output Processing Data)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Analog Output CH0 low byte (Slot#3)							
1	Analog Output CH0 high byte (Slot#3)							
2	Analog Output CH1 low byte (Slot#3)							
3	Analog Output CH1 high byte (Slot#3)							
4	Analog Output CH0 low byte (Slot#9)							
5	Analog Output CH0 high byte (Slot#9)							
6	Analog Output CH1 low byte (Slot#9)							
7	Analog Output CH1 high byte (Slot#9)							
8	Discrete Output 8 pts (Slot#2)							
9	Discrete Output low 8 pts (Slot#4)							
10	Discrete Output high 8 pts (Slot#4)							
11	Discrete Output 8 pts (Slot#6)							
12	Discrete Output low 8 pts (Slot#10)							
13	Discrete Output high 8 pts (Slot#10)							
14	Discrete Output 4 pts (Slot#5)				Discrete Output 4 pts (Slot#1)			
15	Discrete Output 2 pts (Slot#8)		Discrete Output 2 pts (Slot#8)		Discrete Output 4 pts (Slot#11)			

3) DeviceNet I/O Data Format Setting

I/O Data format of NA-9111/9112 is able to be changed to DeviceNet Configuration Software Setting Data format by changing object value of Configuration software.

◆ FnBus Manager Object

Class Code : 70Hex

◆ Common Service

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

◆ Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Number of Slot	Usint	Include deactivated slot
	2	Get	Number of Activated Slot	Usint	See Table 1
	3	Get	Number of Deactivated Slot	Usint	See Table 2
	4	Get	Module Serial IDs	Array of Byte	Array size defined by attribute.1
	5	Get/Set*	Selection of Produced Connection Type	Usint	Default 0
	6	Get/Set*	Selection of Consumed Connection Type	Usint	Default 0
	7	Get/Set*	Slot Active Flag	DWORD	
	8	Get	Slot Live List	DWORD	
	9	Get	Slot Alarm List	DWORD	
	10	Get	FnBUS Status	Usint	0:Normal Operation 1:FnBUS Standby 2:FnBUS Connection Fault 3:Expansion Configuration Fault 4:No Expansion Configuration Module

*After the system is reset, the new "Set Value" action is applied.

*If changed slot location, set default value automatically.

Table 1 Selection of Produced Connection Type

Produced Connection Type Number	Description	Input Assembly Type
0	Uncompressed Input Processing Data + Status	100
1	Uncompressed Input Processing Data	101
2	Compressed Input Processing Data + Status	102
3	Compressed Input Processing Data	103

Table 2 Selection of Consumed Connection Type

Consumed Connection Type Number	Description	Output Assembly Type
0	Uncompressed Output Processing Data	150
1	Compressed Output Processing Data	151

Table 3 Slot Active Flag

DWORD(32bits)	Decimal Bit	Description
Get/Set	Bit 00	Activate/Deactivate flag for slot position#1 (0:Active 1:inactive)
	Bit 01	Activate/Deactivate flag for slot position#2 (0:Active 1:inactive)
	Bit 03	Activate/Deactivate flag for slot position#3 (0:Active 1:inactive)
	. . .	. . .
	Bit 31	Activate/Deactivate flag for slot position#32 (0:Active 1:inactive)

Table 4 Slot Live List

DWORD(32bits)	Decimal Bit	Description
Get/Set	Bit 00	This bit is set(1) When slot position#1 is available to exchange IO
	Bit 01	This bit is set(1) When slot position#2 is available to exchange IO
	Bit 02	This bit is set(1) When slot position#3 is available to exchange IO
	. . .	. . .
	Bit 31	This bit is set(1) When slot position#32 is available to exchange IO

Table 5 Slot Alarm List

DWORD(32bits)	Decimal Bit	Description
Get/Set	Bit 00	This bit is set(1) When an error is detected in slot position #1
	Bit 01	This bit is set(1) When an error is detected in slot position #2
	Bit 02	This bit is set(1) When an error is detected in slot position #3
	. . .	. . .
	Bit 31	This bit is set(1) When an error is detected in slot position #32

4) EDS & I/O Module Setting

An Electronic Data Sheet(EDS) provides information necessary to access and alter the configuration parameters of a device. EDS is an external file that contains information about configurable attributes for the device, including object addresses of each parameter.
The application objects in a device represent the destination addresses for configuration data. These addresses are encoded in EDS.

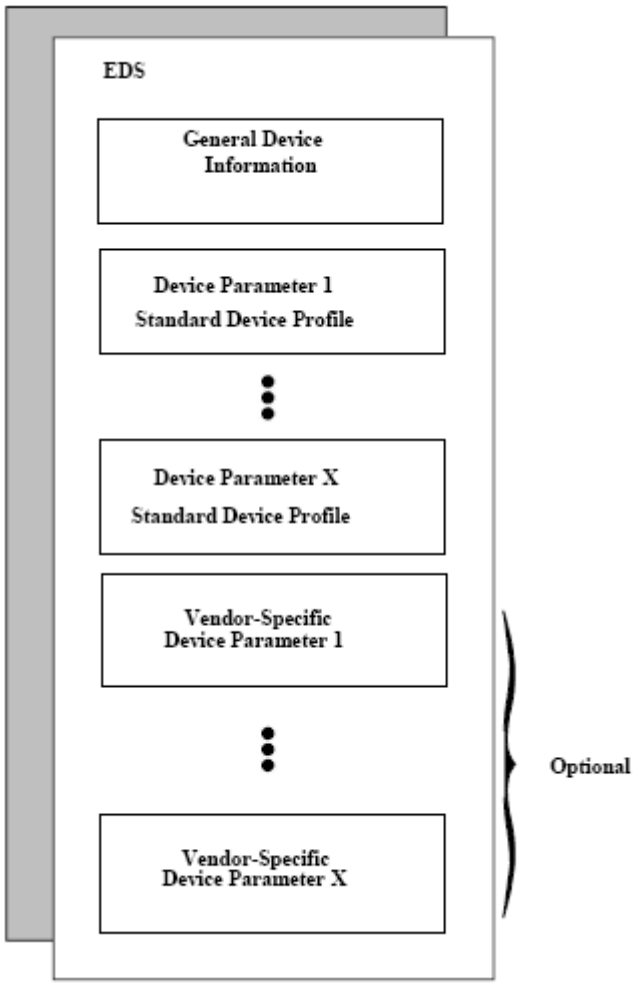


Figure 1 : General block diagram of an EDS file

When Configuration tool is started, it automatically retrieves all the EDS files stored in the EDS directory. The device names are placed into an internal list.
During the configuration, the device-specific data is retrieved directly from EDS files.
If a DeviceNet Device does not appear in the selection list, a corresponding EDS file can be copied in to the EDS directory with File > Copy EDS.

The EDS files of some vendors are available on the DeviceNet homepage http://www.odva.org or visit the homepage of the manufacturer.

The EDS directory is adjustable. In order to alter the directory from a previous setting in another directory, use the menu Settings > Path.
All EDS files must be placed in this directory.

3. DeviceNet Network Installation

DeviceNet Network Set up is like following figure2.

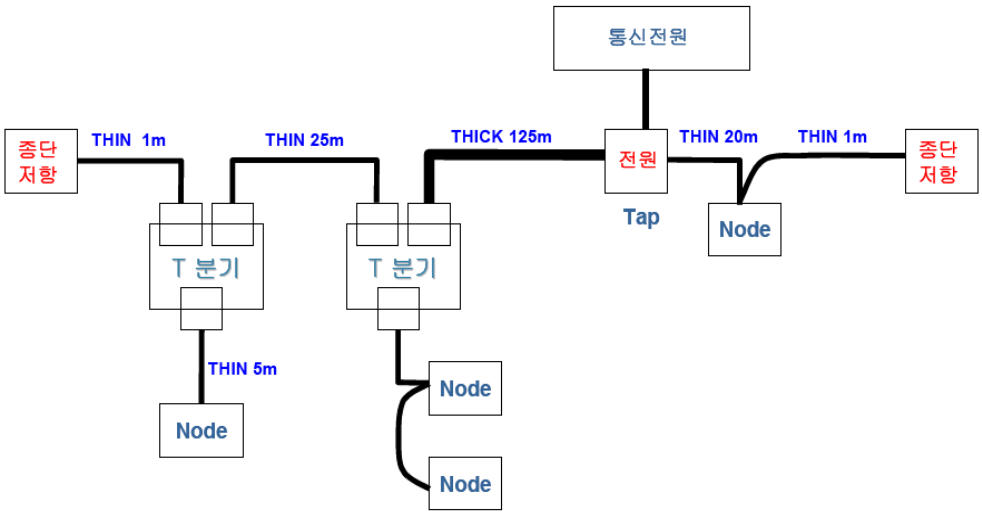


Figure 2. DeviceNet Network Example.

◆ Network Construction Concept

Node	For DeviceNet Node there are Master arranging external I/O of each Slave and Slave connecting external I/O .
Trunk Line/Branch Line	Trunk line means the cable attached terminal resistor on both edges. a Branch line means the cable branched off from trunk line. For DeviceNet , the Trunk and Branch Line are communicating by using the Devicenet dedicated cable.
Connection Type	There are 2 types of Node connection types for DeviceNet . T-Branch diverged by T-Branch Tap and Multi Drop connection connected directly with Node by Trunk/Branch Line.
Terminal resister	The resisters are attached at both edges of cable. The resister reduces reflected wave at terminal point and prevents disturbance of signal
Communication Power	To use DeviceNet, the communication power is supplied to connector of each Node via the DeviceNet dedicated cable.

1) DeviceNet Cable Specification

The DeviceNet dedicated Cable is specified in DeviceNet Specification as below ;
(DeviceNet Specification Volume I Release2.0 Errata2, Appendix B)

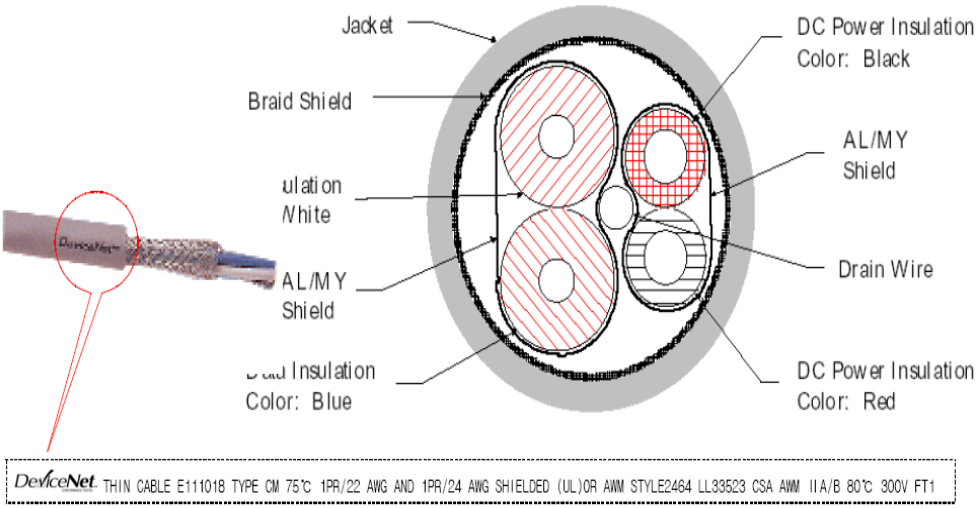


Figure3. DeviceNet Cable

Physical Characteristics	Thick Cable Spec	Thin Cable Spec
Conductor Pair Size	#18 Copper(min.); 19 strand min. (individually tinned)	#24 Copper(min.); 19 strand min. (individually tinned)
Insulation diameter	0.150 inches	0.077 inches
Colors	Light Blue White	Light Blue White
Pair twist/ft	3(approx.)	5(approx.)
Impedance	120Ω ± 10% (at 1 MHz)	
Power pair		
Conductor Pair Size	#15 Copper(minimum); 19 strand min. (individually tinned)	#22 Copper(minimum); 19 strand min. (individually tinned)
Insulation diameter	0.098 Inches	0.055 Inches
Color	Red,Black	Red,Black
Tape shield over pair	1.0mil/1mil,Al/Mylar Al side out w/shorting fold(pull-on applied)	1.0mil/1mil,Al/MylarAl side out w/shorting fold(pull-on applied)
Drain Wire	#18 Copper(minimum); 19 strand min.	#22 Copper(minimum); 19 strand min.
Roundness	Radius delta to be within 15% of 0.5 O.D	
Agency Certification	NEC(UL) type CL2(min.)	
Jacket marker	Vender name & part# ,and additional	

The maximum length of network for each cable type is as follows

Communication Rate	Trunk Length	Trunk Exchange (Thick Cable)	Cumulative Drop	Maximum Drop

125Kb	500m(1640ft)	1.0	156m(512ft)	6(20ft)
250Kb	250m(820ft)	1.0	78m(256ft)	6(20ft)
500Kb	100m(328ft)	1.0	39m(128ft)	6(20ft)

Figure 3. Thick Cable

Communication Rate	Trunk Length	Trunk Exchange (Thin Cable)	Cumulative Drop	Maximum Drop
125Kb	100m(328ft)	5.0	156m(512ft)	6(20ft)
250Kb	100m(328ft)	2.5	78m(256ft)	6(20ft)
500Kb	100m(328ft)	1.0	38m(128ft)	6(20ft)

Figure 4. Thin Cable

2) DeviceNet Connector

◆ DeviceNet 5 Pin Open Connector Spec. is as follows

Male General Characteristics	Specification
Number of Pins	5
Coupling Nut	None
Coupling Nut Thread	None
Rotation	None
PinOut	V-:Pin1,CAN_L:Pin2,Drain:Pin3,CAN_H:Pin4,V+:Pin5
Female General Characteristics	Specification
Number of Sockets	5
Coupling Nut	None
Coupling Nut Thread	None
Rotation	None
PinOut	V-:Pin1,CAN_L:Pin2,Drain:Pin3,CAN_H:Pin4,V+:Pin5
Physical Characteristics	Specification
Wiping Contact Plating Requirements	30 micro inch gold minimum over 50 micro inch nickel minimum or 5 micro inch gold minimum over 20 micro inch palladium-nickel minimum over 50 micro inch nickel. All gold must be 24 Karat
Wiping Contract Life	1000 insertion-extractions
Electrical Characteristics	Specification
Operating Voltage	25 Volt minimum
Contact Rating	8 amps minimum

Figure 5. DeviceNet 5pin Open Connector

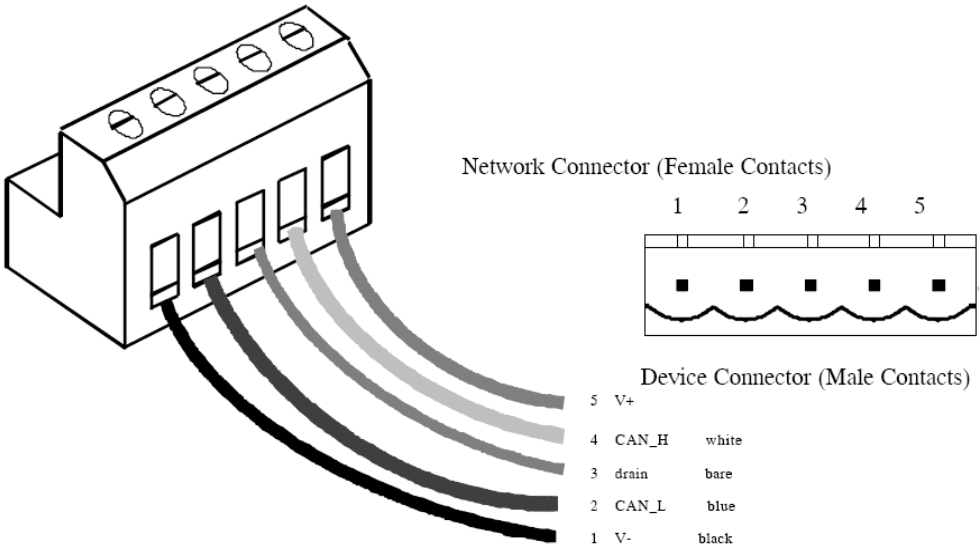


Figure 6. Open Connector Pinpoint

◆ DeviceNet Sealed Mini Connector Spec is as follows

Male General Characteristics	Specification
Number of Pin	5
Coupling Nut	Male
Coupling Nut Thread	7/8-16 UN-2A THD
Rotation	Optional
PinOut	Drain:Pin1,V+:Pin2,V-:Pin3,CAN_H:Pin4,CAN_L:Pin5
Female General Characteristics	Specification
Female General Characteristics	Specification
Number of Sockets	5
Coupling Nut	Female
Coupling Nut Thread	7/8-16 UN-2B THD
Rotation	Required
PinOut	Drain:Pin1,V+:Pin2,V-:Pin3,CAN_H:Pin4,CAN_L:Pin5
Physical Characteristics	Specification
Wiping Contact Plating Requirements	30 micro inch gold minimum over 50 micro inch nickel minimum or 5 micro inch gold minimum over 20 micro inch palladium-nickel minimum over 50 micro inch nickel. All gold must br 24 Karat

Figure 7. Sealed Mini Connector

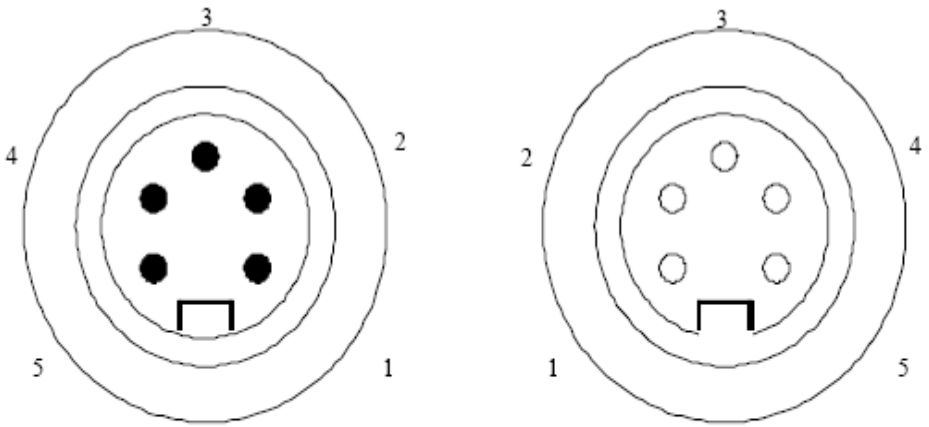


Figure 8. Mini Connector Pinpoint

◆ Network Power

DeviceNet Network Power is 24V. Network and I/O Filed Power must be separated. One Power supply is provided per network.

3) Terminator Resistors

Specification of terminator Resistors are as follows Resistance Spec : 120Ω,1%,1/4W

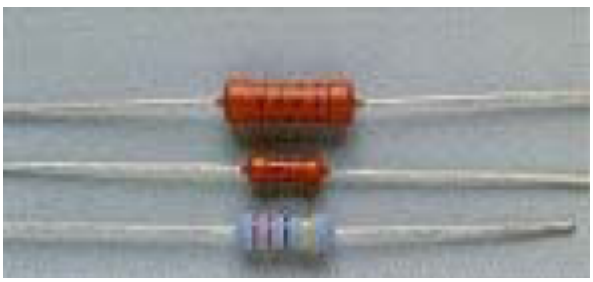


Figure 9. Terminator Resistors

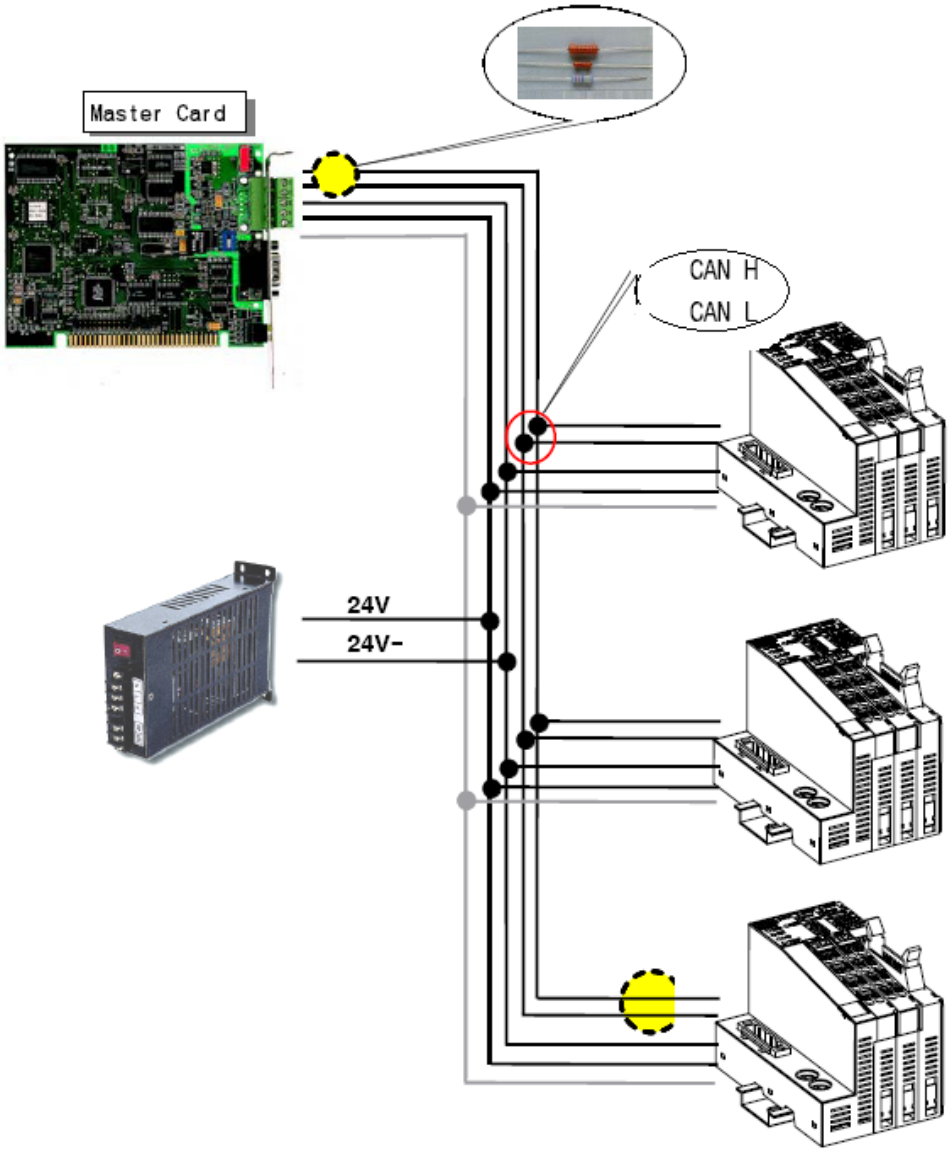


Figure 10. End-Station resistance Position

4. Check Operation Status

When all installation and configuration processes are complete, the adaptor module status LED(MOD LED) and network status LED(Net LED) shall be lit in a green color. If not, it indicates that an error has occurred. See the following table for proper measures.

1) MOD : Module Status LED

State	LED is	Description
No Power	Off	No power is supplied to the unit
Device Operational	Green	The unit is operating in normal condition
Device in Standby	Flashing Green	The EEPROM parameter is not initialized yet Serial Number is zero value (0x00000000)
Minor Fault	Flashing Red	The unit has occurred recoverable fault in self-testing - Too many expansion slot - Overflow IO size - IO configuration failure - EEPROM check fault
Unrecoverable	Red	The unit has occurred unrecoverable fault in self-testing - Invalid Module ID - Firmware fault

2) NET : Network Status LED

State	LED is	Description
No Powered Not On-line	Off	Device is not on-line or May not be powered - Not completed the Dup-MAC-ID test yet
On-line, Not connected	Flashing Green	Device is on-line but has no connections in the established state - Passed the Dup-MAC-ID test - Not allocated to a master
On-line, Connected	Green	Device is On-line and allocated to a master

Connection time-out	Flashing Red	One or more I/O connections are in the time-out state
Critical Communication Failure	Red	Failed communication - Duplicate MAC ID - Bus-off

3) I/O : Expansion Module Status LED

State	LED is	To Indicate
Not Powered No Expansion Module	Off	Device has no expansion module or may not be powered
FnBus Connection Run Exchanging I/O	Green	FnBus Normal Operation
Expansion Configuration Failed	Flashing Red	Failed to initialize expansion module - Detected invalid expansion module ID - Overflowed Input/Output Size - Too many expansion module - Initial protocol failure
FnBus connection fault During Exchanging I/O	Red	One or more expansion module occurred in fault state - Changed expansion module configuration - FnBus communication failure

4) Field Power : Field Power Status LED

State	LED is	To Indicate
Not Supplied Field Power	Off	Not supplied 24Vdc field power
Supplied Field Power	Green	Supplied 24Vdc field power

5) Description of Status byte

Bit Description	Decimal Bit	Explanation
Explanation	00-03	0:Exchange IO data(normal operation) 1:Stop Exchanging IO(ready to exchange IO) 2:FnBus Communication Fault 3:Slot Configuration Fault 4:No Expansion Slot
Reserved	04-06	Reserved
Field Power Status	07	0:24Vdc Field Power On 1:24Vdc Field Power Off

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